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THE USE OF AGRICULTURAL FERTILIZERS BY THE AMERICAN INDIANS AND THE EARLY ENGLISH COLONISTS.¹

BY G. BROWNE GOODE.

IN the course of a somewhat exhaustive study of the natural and economical history of that member of the herring family known on our Atlantic coast under such various names as "menhaden," "pogy," "bony-fish," "moss-bunker," "white-fish," "bay-alewife," "bug-fish," "yellow-tail" and "fat-back," *Brevoortia tyrannus* (Latrobe) Goode, my attention was incidentally called to a matter of some interest to anthropologists—the use of fish fertilizers in agriculture by the Indians of New England and Virginia. The menhaden is, at the present day, the source of an immense annual product of commercial fertilizers. In the year 1878 between 900,000,000 and 1,000,000,000, or perhaps 200,000 tons of these fish were captured between Cape Henry and the entrance to the Bay of Fundy. A large part of the catch is consumed by the numerous oil and guano factories of Maine, Rhode Island, New York, Connecticut and Virginia. After the oil has been extracted the remainder is dried and sold to farmers and to the manufacturers of super-phosphates and other artificial fertilizers, who use it as a "base for nitrogen." Agricultural chemists, in the rating of commercial manures, value the nitrogen contained in them at twenty-five cents a pound. The amount of nitrogen derived from menhaden in 1875 was estimated to be equivalent to that contained in 60,000,000 pounds of Peruvian guano, the gold value of which would not have been far from \$1,920,000.

¹ Read before the Anthropological Society of Washington, November, 1879.

In studying the development of this great industry, my attention was naturally directed toward a search for the beginning of the employment of fish in agriculture. As I have narrated elsewhere at considerable length,¹ the present oil and guano industry originated in Maine, about the year 1850, through the experiments of an old woman, who, while boiling some fish for chicken feed, observed the accumulation of a scum of oil upon the surface of the water; and about this time, or a little later, small factories were established in Connecticut and Eastern Long Island. Long before this, however, the farmers of New England and New York were accustomed to manure their corn and potato fields with the entire fish, in a raw state. This custom prevails to a great extent, even to the present day, notwithstanding that the experience of thoughtful agriculturists has shown it to be injurious. The usual method in sowing corn is to place an entire menhaden in each hill, together with the few grains of seed, and in planting potatoes to lay down a continuous row of fish, head to tail, in the furrows, before the potatoes are put in. The oil thus introduced with the flesh into the earth is entirely useless as a fertilizer, and permeating the soil renders it peculiarly liable, first to become soggy and heavy, and then to bake hard and crack with the heat of the sun. Many farms in Connecticut and Long Island are pointed to as having been ruined by this mode of planting.

My friend Prof. Atwater has searched the annals of European agriculture, and can find no record of the use of fish fertilizers before 1850, since which time they have been employed to some extent in Norway, England, Prussia and France. In America, however, their use dates back to the first colonization, and doubtless, as I shall show below, among the Aborigines, long previous to the discovery of the country.

Important, and in fact unanswerable, evidence is supplied by the etymology of the two names, "menhaden" and "pogy" or "poghaden," in use in different parts of New England. I quote from a letter received from Mr. J. Hammond Trumbull, in 1874:

"In response to yours of the 14th (December), respecting the local names of *Brevoortia*, about all I can give you is in my note to the new edition of Roger Williams' Key, Ch. xix. Williams names together, among spring fish, '*Aumsoûg* and *Munnawhat-*

¹A History of the Menhaden, etc., in Report U. S. Commissioner of Fisheries, Part v (for 1877), 1879, pp. 1-529; pp. 161 *et seq.*

teaûg.' Under the former name are included several species of the herring tribe, *aum'su* (plural *uaums'nog*) meaning 'small fish,' *Munnawhatteaûg* corrupted to *menhaden*, means literally 'fertilizer' (that which manures), this name was applied to the herring and alewife as well as the 'menhaden' proper—all these species being used by the Indians for manuring their cornfields.

"In the northern and eastern parts of New England, the *Brevortia* is commonly called *pauhagen*, and probably in some localities 'poghaden' (as you write it and which is nearer the Indian original), though I have not heard it so pronounced by Eastern fishermen. This name in the Eastern dialects has precisely the same meaning as 'menhaden' (or rather *Munnawhatteaûg* in Southern New England). The Abnaki (*i. e.*, coast of Maine) name was *pookagan* as Rasles wrote it, and the verb from which it is derived he translated by '*on engraisse la terre.*'"

I next appeal to the records of the Colonies. In Governor Bradford's "History of Plimouth Plantation," is given an account of the early agricultural experiences of the Plymouth colonists. In April, 1621, at the close of the first long dreary winter, "they (as many as were able) began to plant their corne, in which service Squanto (an Indian) stood them in great stead, showing them both ye manner how to set it and after how to dress & tend it. Also he tould them, axcepte they got fish & set with it (in these old grounds) it would come to nothing; and he showed them yt in ye middle of Aprill, they should have store enough come up ye brooke by which they begane to build and taught them how to take it."¹

Another allusion to the practice of the Indians in this respect may be found in George Mourt's "Relation or Journal of the Beginning and Proceedings of the English Plantation settled at Plimoth, in New England, by certain English Adventurers both Merchants and others. * * * London, 1622." "We set the last spring some twenty acres of Indian corn, and sowed some six acres of barley and pease, and, according to the manner of Indians, we manured our ground with herrings, or rather shads, which we have in great abundance and take with great ease at our doors. Our corn did prove well, and God be praised, we had a good increase of Indian corn, and our barley indifferent good."²

¹ Coll. Mass. Hist. Soc., 4th Series, III, 1856, p. 100.

² Coll. Mass. Hist. Soc., 2d Series, IX, 1832, p. 60.

The fish made use of by the early settlers of Massachusetts were doubtless in large part the spring alewife, *Pomolobus vernalis*, and perhaps also the summer alewife, *P. æstivalis*, and an occasional shad, *Alosa sapidissima*.

I can find no other direct allusions to the Indians in this connection, but may quote two passages relating to the practices of the early colony, which are quite significant in the light of those already presented. Thomas Morton, in his "New England Canaan," London, 1632, wrote of Virginia: "There is a fish (by some called shadds, by some, allizes) that at the spring of the yeare passe up the rivers to spawn in the pond, & are taken in such multitudes in every river that hath a pond at the end that the inhabitants dounge their grounds with them. You may see in one township a hundred acres together, set with these fish, every acre taking 1000 of them, & an acre thus dressed will produce and yeald so much corn as 3 acres without fish; & (least any Virginea man would infer hereupon that the ground of New England was barren, because they use more fish in setting their corne, I desire them to be remembered, the cause is plaine in Virginea) they have it not to sett. But this practice is onely for the Indian maize (which must be set by hands), not for English grain: & this is, therefore a commodity there."

This passage is very interesting, describing as it does the use of fish fertilizers in Virginia two hundred and fifty years ago or more. To one who is acquainted with the habits of the herring family in the Virginia rivers and the persistency of local names, there can be little doubt that many menhaden were used as well as shad and the two kinds of river herring, all of these being common, in spring, in all the streams tributary to Chesapeake bay.

In Edward Johnson's "Wonder-Working Providence of Sion's Saviour in New England, being a Relation of the Firste Planting of New England in the yeare 1628," London, 1654, written in 1652, the author says: "But the Lord is pleased to provide for them (the colonists) great store of fish in the Spring-time, especially alwives, about the bignesse of a herring. Many thousand of these they used to put under their Indian corne, which they plant in hills five foot asunder; and assuredly when the Lord created these corne, Hee had a special eye to supply these His people's wants with it, for ordinarily five or six grains doth produce six hundred."

The following order from the records of the town of Ipswich, May 11, 1644, illustrates in a comical way the customs of the early colonists: "It is ordered that all the doggs for the space of three

weeks after the publishing hereof, shall have one legg tyed up, and if such a dog shall break loose and be found doing any harm the owner of the dogg shall pay damage. If a man refuse to tye up his dogg's legg, and hee bee found scraping up fish in a corne-field, the owner thereof shall pay twelve pence damage beside what ever damage the dogg doth. But if any fish their house lotts and receive damage by doggs, the owners of these house lotts shall bear the damage themselves."

From this time until the latter part of the last century, I can find no reference to the use of fish fertilizers, but there is no reason to doubt that the customs of old have been handed down by the local agriculturists from generation to generation.

I have been much astonished to find that the use of fertilizers by the uncivilized races of man has not been more frequently observed. Dr. Rau, with his extensive acquaintance of ethnological literature, tells me that he has met with but one allusion of the kind, that being in the writings of Garcilasso de Vega, who states that the Peruvians used bird guano for the purpose of manuring their plantations.¹

Bancroft refers to one instance of the use of fertilizers by the

¹"They used to dung their Lands, that they might make them fruitfull, and it is observable, that in all the Valley about *Cosco*, and in the hilly Countries, where they sowed *Mayz*, they esteemed the best manure to be Man's Dung; and to that end they saved and gathered it with great care, and drying it, they cast it upon their Land before they sowed their *Mayz*. But in the Country of *Collao*, which is above one hundred and fity Leagues long, which, by reason of the coldness of the Climate, doth not produce *Mayz*, though it bear other sort of Grane, there they esteem the Dung of Cattle to be the best manure and improvement.

"By the Sea-coast, from below *Arequipa*, as far as *Tarapaca* which is above two hundred Leagues, they use no other Dung, but such as comes from the Sea-birds, of which there are great numbers and incredible flocks on the Coast of *Peru*; they breed in little Islands, which lie in the Sea, and are unpeopled, where they lay such heaps of Dung, that at a distance they seem to be Hills of Snow, in the times of the *Incas*, who were Kings, great care was taken of these Birds in the season of their Breeding; for then on pain of death no Man was to enter on those Islands, lest they should disturb the Birds, or spoil their Nests; nor was it lawfull to take or kill them at any time, either off or upon the Island.

* * * * *

"Howsoever in other parts of that Coast, and in the Low Countries of *Atica*, *Aliquipa*, *Villacori*, *Malla* and *Chilca*, and other Vallies, they dung their grounds with the Heads of a small fish, like our Pilchards, and with no other soilage.

* * * * *

"Not there are such quantities of Pilchards cast up by the Sea at those seasons, as are not only sufficient for the Food of Man, and Birds, and for dunging the earth, but even to lade many Ships, if occasion should require. It is said that this Fish is chased ashore by some Dolphins, or greater Fish; be it by what means it will, the advantage is great, and the Providence of God is admirable in these His Blessings towards His poor Creatures."

Garcilasso de la Vega: The Royal Commentaries of Peru. Translated from the Spanish by Sir Paul Rycaut, Lond. 1688, pp. 135-36.

Indians on the Pacific coasts. In describing the customs of the Maya tribes of Yucatan (Vol. ii, p. 717) he paraphrases a translation of the Quiché MS. by Brasseur De Bourbourg, in relation to the culture of maize by them: "And from the time of its traditional discovery by Gucumatx or Quetzalcoatl (the creator and former) down to the conquest by the Spaniards, and even down to the present time, the yellow and white maize, or their several varieties, have been the chief reliance of the Maya as of the Nahua nations for daily food. Every year, during the latter month of the dry season, from March to May, the farmer busied himself in preparing his *milpa* or cornfield, which he did by simply cutting or up-rooting the dense growth and burning it. The ashes thus produced were the only fertilizer ever employed, and even this was probably never needed in this land of tropical fertility. Just before the first rain fell, equipped with a sack of seed-maize on his shoulder and a sharpened stick in his hand, he made holes at regular intervals among the ashes, and in each deposited five or six grains, covering it with the same instrument, aided perhaps with his foot," etc., etc. This is evidently accidental rather than intentional fertilization, the main object of the burning being doubtless to clear away the obstructions to planting the seed. Dr. Rau also showed me accounts of the agriculture of various American tribes, and particularly a very full one of the culture of maize by the Iroquois, in Lafittau's "*Mœurs des Sauvages Américains*," Paris, 1724, none of which referred in any way to the use of manure.

While traveling on the north shore of Lake Superior last summer, Prof. Atwater learned that the Indians of that region employ, to some extent, white fish and lake trout in manuring their fields. Mr. W. H. Dall tells me that a rude system of agriculture is practiced by the Indians of Alaska, a system learned from the Russians since their occupation of the territory.

I have presented these few notes, not as a contribution to knowledge, but to call attention to a subject which seems to have been neglected in a most unaccountable manner. Can it be that the aborigines of the Northern Atlantic States are the only uncivilized people who have understood the use of agricultural fertilizers? Fish fertilizers naturally are inaccessible except to peoples living on large bodies of water abounding in schools of fish, which may be taken with ease in quantities greater than are

needed for use as food. Not less interesting, however, would be instances of the use of organic refuse derived from other sources. Can it be possible that the agricultural Indians of America, such, for instance, as the Moquis, have never thought of making this very obvious application of their domestic animals? When did the Aryan races take their first steps in provident agriculture? These questions must be extremely important to those who are studying the development of culture and civilization.

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A SKETCH OF COMPARATIVE EMBRYOLOGY.

BY CHARLES SEDGWICK MINOT.

IV.—THE EMBRYOLOGY OF SPONGES.

DURING the past six years our knowledge of the structure and development of sponges has made sudden and very great progress, perhaps greater than has occurred in any other department of zoölogy during the same period. The advance was introduced by the publication, in 1872, of Haeckel's monograph of the calcareous sponges. That work has been followed, in Germany, England, France and Russia, by numerous memoirs, among which the series of articles by Franz Eilhard Schulze stand first by their accuracy, their clearness, the beauty of the illustrations and the good temper (sometimes wanting in German scientific publications) of the criticisms on other investigators, but above all, by the value of the discoveries they announce. I think no zoölogist can read Schulze's papers without enjoying their rare combination of merits.

One of the results of these numerous recent researches has been to show that Haeckel's work is inaccurate to a startling extent. He figures in detail things he cannot have seen, because they do not exist, and he describes phenomena that do not occur. His fault is to make very positive statements and give very diagrammatic figures after a hasty examination, consequently his writings contain so numerous errors, sometimes about fundamental points, that even a positive statement of his, until confirmed by other investigators, has no authoritative value. This defect is most seriously to be deplored, for Haeckel is unquestionably one of the most daring and original thinkers of the modern speculative school, and many of his quickly made generalizations have